Minor 1: MAL732 Financial Mathematics
September 02, 2015

Max Marks 20 **Max Time 1 hr**

First 6 questions = 6 × (1+1) = 12 marks; Last 2 questions = 2 × 4 = 8 marks
No fractional marking.

All notations are standard.

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1. You wish to invest a money and have narrowed to the following investments:
   (i) at interest rate $r^{(12)} = 10.15\%$
   (ii) at interest rate $r^{(4)} = 10.25\%$.
   Which investment would you choose? Justify.

2. It is estimated that a machine will need replacing at the end of 10 years from now at a cost of Rs 80000. How much money must be put aside at the end of each year to provide that amount of money if the savings earn interest 8% per annum compounded annually.

3. What is the rate of return on a 90-day investment in a one year maturity zero coupon bond with a face value of Rs 1 whose price at $t = 0$ is $Z(0,1)$= Rs 0.85. Take 265 trading days in an year for calculations in this question.

4. You purchased a coupon bond redeemable at par and have a yield 6% per annum compounded annually and a face value Rs 10000. If the annual coupons are paid at the rate of 8% per annum and it has 15 years to maturity, then how much you have to pay for for one unit of such a bond right now?

5. Let A(1) = Rs 100, S(0) = Rs 100 and

$$S(1) = \text{Rs} \begin{cases} 125 & \text{with probability } 0.4 \\ 80 & \text{with probability } 0.6 \end{cases}$$

   If a long position is taken on a European call option on this stock with $T = 1$ and K = Rs 105, then how much one has to invest in the stock S and the risk-free bond A to replicate this call?

6. Find the value of a European put option expiring in time 2 units with a strike price Rs 65 on a stock with $S(0)$ = Rs 60 in a binomial model with $u = 1.1$, $d = 0.95$, $r = 0.03$.

7. (a) What is the payoff of the portfolio comprising of three short European call with a strike price Rs 90, two long European put with a strike price Rs 80, and 2 long European call with a strike price Rs 70 on the same underline stock and having same expiry time T when $S(T) \in [60, 110]$. Draw the payoff diagram of this portfolio.

   (b) What is the minimum and maximum payoffs from this portfolio when somehow it is known that $S(T) \in [0, 200]$. [3 + 1]

8. Consider a stock whose price on January 01, 2015 is Rs 200 and which will pay a dividend of Rs 2 on July 1, 2015 and Rs 1 on October 1, 2015. Let the interest rate be 10% per annum continuous compounding. If, on January 1, 2015, the forward price for delivery of one unit of this stock on November 1, 2015 is Rs 215, then is there an arbitrage opportunity? If YES, then explain in detail as to what investment decisions will you take during January 1 - November 1, 2015, to create an arbitrage. [2 + 2]